(GB Patent application no. 8204198)

PATENTS ACT 1977

12 FEB 1982

PATENTS FORM NO. 1/77
(Rules 6, 16, 19)

The Comptroller
The Patent Office
25 Southampton Buildings
London WC2A 1AY

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04198

15FEB0866 PAT 0.007.00

REQUEST FOR THE GRANT OF A PATENT

320495

THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION

I **Applicant's or Agent's Reference** GWS/PG 1081

II Title of Invention VEHICLE DRIVE TRANSMISSION

III **Applicant or Applicants** *(See note 2)*

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Address

Nationality

IV Inventor *(See note 3)*

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(a) ~~The applicant(s) is/are the sole/joint inventor(s)~~
or
(b) A statement on Patents Form No. 7/77 is/will be furnished

V Authorisation of Agent FORRESTER, KETLEY & CO.

VI Address for Service

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VII Declaration of Priority *(See note 6)*

Country	Filing date	File number
Great Britain	26 JUNE 1981	8119769

V The Application claims an earlier date under Section 8(3), 12(6), 15(4) or 37(4) *(See note 7)*

Earlier application of patent number and filing date

(Check list *to be filled in by applicant or agent*)

A	The application contains the following number of sheets:			B	The application as filed is accompanied by:-
1	Request	one	Sheet(s).	1	~~Priority document~~
2	Description	seven	Sheet(s).	2	~~Translation of priority document~~
3	Claim(s)	-	Sheet(s)	3	~~Request for Search~~
4	Drawing(s)	three	Sheet(s)	4	~~Statement of Inventorship and Right to Apply~~
5	Abstract	-	Sheet(s)	5	~~Request~~ Authorisation of Agent - ON FILE

C It is suggested that figure No. of the drawings (if any) should accompany the abstract when published

D Signature *(See note 8)*

FORRESTER, KETLEY & CO.

Forrester, Ketley & Co.

Agents

NOTES:

1 This form, when completed, should be brought or sent to the Patent Office together with the prescribed fee and two copies of the description of the invention.

2 The name, address and nationality of each applicant are to be stated in the spaces provided at III. Names of natural persons should be indicated in full. Bodies corporate should be designated by their corporate name. If there are more than two applicants the information concerning the third (and further) applicants should be given on a separate sheet.

3 Where the applicant or applicants is/are the sole inventor or the joint inventors, the declaration (a) to that effect at V should be completed and the alternative statement (b) deleted. If however this is not the case the declaration (a) should be struck out and a statement will then be required to be filed upon Patents Form No.7/77.

4 If the applicant wishes to appoint an agent, his name and address of his place of business shall be indicated in the spaces available at V and VI. Such indication will be considered to be an authorisation for the agent to prosecute the application to grant of a patent and to service any patent so granted.

5 If no authorised agent is appointed an address for service in the United Kingdom to which all documents and notices may be sent must be stated at VI. It is recommended that a telephone number be provided if available.

6 The declaration of priority at VII should state the date of the previous filing and the country in which it was made and the application number if available.

7 Where an application is made by virtue of section 8(3), 12(6), 15(4) or 37(4) the appropriate section should be identified at VIII and the number of the earlier application or any patent granted thereon identified.

8 An agent may sign only when previously authorised. An express authorisation signed by the applicant(s) must be received by the Patent Office before the expiry of 3 months from the filing date.

9 Attention of applicants is drawn to the desirability of avoiding publication of inventions relating to any article, material or device intended or adapted for use in war (Official Secrets Acts, 1911 and 1920). In addition after an application for a patent has been filed at the Patent Office the comptroller will consider whether publication or communication of the invention should be prohibited or restricted under section 22 of the Act and will inform the applicant if such prohibition appears necessary.

10 Applicants resident in the United Kingdom are also reminded that, under the provisions of section 23 applications may not be filed abroad without written permission or unless an application has been filed not less than six weeks previously in the United Kingdom for a patent for the same invention and no direction prohibiting publication or communication has been given or any such direction has been received.

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DUPLICATE

PATENTS ACT 1977

GWS/PMcD/PG 1081

Description of Invention

VEHICLE DRIVE TRANSMISSION

ILE

THIS INVENTION relates to drive transmissions for land vehicles.

Within the ambit of expressions such as 'coupling' and 'clutch', devices have been proposed which are capable continuously of developing a restraining torque simultaneously with permitting 'slip' and which are yet not prone to excessive wearing and which can be manufactured economically. Such a device is described in British Patent Specification No. 1 357 106 wherein the device is called 'a control coupling'. In the present Specification, the term 'slip coupling' is to be taken to include a control coupling.

It has been proposed to incorporate a slip coupling into a differential gear in a vehicle transmission in order to restrain excessive differential action and so restrain wheel spin and/or oppose wheel locking. This has meant the inclusion of additional components and therefore increased cost.

According to one aspect of the present invention, there is provided a drive transmission for a land vehicle, comprising slip coupling means having mutually independently rotatable output elements arranged and connected for delivering torque to respective roadwheels.

Preferably, the output elements are disposed within a singl housing.

Pr f rably, the said h using incorporates a final drive reduction gear m mber.

Preferably, the drive transmission comprises other roadwheels, and a differential g ar arrang d and con-

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nected to d liver torque to said other road wheels, an input to said differential g ar being in driving connection with an input to said slip coupling means.

The slip coupling means will be adapted to be capable of delivering sufficient torque to enable transmission of power usefully to the associated roadwheels while also permitting differential rotation of these roadwheels by virtue of slip.

According to another aspect of the present invention, there is provided a land vehicle live axle assembly comprising slip coupling means having mutually independently rotatable output elements arranged for delivering torque respectively to nearside and offside roadwheels.

In a differential gear incorporating a slip coupling, torque is delivered to associated roadwheels by way of the differential elements; and the slip coupling serves solely to restrain differential action.

In accordance with a further aspect of the present invention, slip coupling means delivers torque to associated roadwheels and a differential gear is dispensed with.

In a modification of any of the aforesaid aspects of the present invention, there is provided lock out means operable to prevent slip operation of at least part of said slip coupling means so that during operation of a drive transmission incorporating the slip coupling means drive is transmitted positively to at least one of the road wheels associated with the slip coupling means.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Fig 1 is a diagramatic repr sentation of th lay-out of a land vehicle drive transmission in accordance with the pres nt invention;

Fig 2 is a part-sectional view in plan of part of

a live axle assembly in accordance with the pr sent invention, being a part of the tranmission of Fig 1 to a larger scale than Fig 1; and

Fig 3 is a part-sectional view similar to Fig 2, but incorporating a lock out means.

In Fig 1, the land vehicle transmission drives steerable front wheels 10 and rear wheels 11. The front wheels 10 have driving torque delivered to them by means of a final drive assembly indicated by reference numeral 12, the latter assembly incorporating an inter-wheel differential gear which itself may incorporate a control coupling such as described and/or claimed in the aforementioned British Patent Specification No 1 357 106. The final drive assembly 12 is driven by an engine, clutch and gear-box assembly indicated generally by reference numeral 13. The transmission is substantially conventional so far as concerns the drive to the front wheels 10.

The rear wheels 11 are mounted on a live axle assembly incorporating a final drive indicated by reference numeral 14. This final drive 14 is described in detail hereinafter with reference to Fig 2. An input to the final drive 14 is connected to the engine, clutch and gear-box assembly 13 by means of a propeller shaft 15 incorporating universal joints 16. Thus, the input to the final drive 14 is placed in driving connection with the input to the final drive 12 and the differential gear incorporated therein.

More particularly, in Fig 2, the final drive 14 incorporates final drive reduction gear members in the form of a pinion 17 and crown wheel 18 respectively. The pinion 17 constitutes the input member of the final drive 14 and has a pinion shaft 17A which is connected to the rearmost universal joint 16. The crown wheel 18 drives nearside and offside half-shafts 19 and 20 respectively through the agency of a slip coupling which is indicated generally in Fig 2 by reference

numeral 21. Th final drive reduction gear members 17 and 18 and the slip coupling 21 are contained within a housing defined partly by cast casing 22 and a pressed steel cover 23.

The slip coupling 21 consists of a hollow cylindrical housing 24 which carries a flange portion 25 to which the crown wheel 18 is bolted. The housing 24 is journalled for rotation in taper roller bearings 26. The offside end wall of the housing 24 is made separately from the main body of the housing and is located in place by means of a circlip 27, and incorporates a seal 28. The half-shafts 19 and 20 are journalled in mutually coaxial bearings in the nearside and offside end walls of the housing 24, the inner ends of the half-shafts abutting in the vicinity of the centre of the housing 24. The inner wall surface of the housing 24 is splined and carries a first set of annular plates 29 such as those described as 'outer' plates in the aforementioned Patent Specification No. 1 357 106. The inner ends of the half-shafts 19 and 20 are also splined and the nearside half-shaft end portion within the housing 24 carries a second set 30 of annular plates such as those described as 'inner' plates in the aforementioned Patent Specification. Similarly, the inner end portion of half-shaft 20 carried a third set 31 of 'inner' plates. In Fig 2, only one annular plate of ech 'inner' set is shown; and only four plates of the 'outer' set. The housing 24 contains also a viscous fluid, and space to accommodate expansion of the fluid within limits up to a predetermined working temperature. Again, in this connection, reference is made to the disclosure in the aforementioned Patent Specification No. 1 357 106.

The roadwh l diameters and the driv transmi sion ratios of the drive transmission are such that during normal travel in a straight lin the housing 24 will rotate at substantially th sam speed as the half-

shafts 19 and 20. Thus, there will be little or no mutually independent rotation or 'differential action' of the half-shafts 19 and 20.

The operation of the drive transmission of Figs 1 and 2 is as follows. During normal travel under drive from the engine, clutch and gear-box assembly 13, torque is delivered positively to the front roadwheels 10 by way of the differential gear incorporated in the final drive assembly 12. Simultaneously, the drive transmission associated with the rear wheels 11 will operate 'neutrally', that is without torque being delivered to the rear wheels while the slip coupling 21 rotates bodily. Also on overrun, 'engine braking' torque is delivered to the front roadwheels 10 by way of the differential gear incorporated in the final drive assembly 12; and the drive transmission associated with the rear wheels remains 'neutral'. In the event of wheel spin at either of the front roadwheels 10, the input to the final drive 14 will accelerate and so generate slip within the slip coupling 21 thus causing driving torque to be delivered to each of the rear wheels 11 through the half-shafts 19 and 20. Similarly, should either of the front roadwheels 10 tend to lock during braking, a deceleration of the drive transmission to the rear will result in 'anti-locking' torque being delivered to the front drive by virtue of torque generated by slipping in the slip coupling 21. During 'normal' travel, differential action between the rear roadwheels 11 is permitted by slip within the slip coupling 21 at a level not sufficient to generate any significant torque.

The vehicle driv transmission described above provides the possibility of obtaining some advantages of a more conv ntional four-wheel-drive arrangement, but with gr ater economy.

In on modification of the drive transmission of

Figs 1 and 2, the single slip coupling unit 21 is replaced by two separate units each having a single set of 'inner' plates, one unit being incorporated in each final drive shaft to a respective roadwheel.

In Fig 3, the drive transmission is the same as that of Fig 2 except that a lock out means is incorporated. In Figs 2 and 3, the same reference numerals are used for mutually equivalent components. A modified casing 22A defines a chamber 32 accommodating a lock out means indicated generally by reference numeral 33 and a lock out actuator 34. The portion of the housing 24 journalled in bearing 26 extends into the chamber 32 and forms an externally splined collar 35 whereon is slidably mounted an internally splined clutch ring 36 having an external annualar groove engaged by a fork portion (not shown) of the actuator 34. A modified half-shaft 20A has an externally splined portion 37 co-axial with the collar 35 so that the half-shaft 20A can be locked for rotation with the housing 24 by means of the clutch ring 36. Appropriate operation of the actuator 34 is effected by means of a diaphragm actuator 38 which is in communication through appropriate valve means (not shown) with the engine induction manifold. In Fig 3, the lock out means is shown in its operative condition as used for example in emergency or breakdown circumstances to transmit positive drive to the road wheel associated with half-shaft 20A. During normal driving conditions, the clutch ring 36 adopts the position shown in broken outline in Fig 3.

In the Fig 3 embodiment, the lock out means 33 prevents slip operation of only part of the slip coupling 21. It will be appreciated that additional lock out means can be provided in ord r to pr vent slip operation of the ntire slip coupling 21, such additional lock out means being disposed in association with the half-shaft 19.

It will be appreciated that various alternative

drive transmission layouts incorporating the present invention are possible. For example, the final drive assembly incorporating a differential gear may be disposed at the rear of the vehicle, with the slip coupling final drive at the front. Alternatively, for example in heavy vehicles, one of the axles in a 'tandem' arrangement may incorporate a differential gear and the second axle may incorporate a slip coupling for delivering torque to its associated roadwheels.

It is also envisaged that the roadwheel diameters and/or the various drive transmission ratios may be chosen so that during normal travel a predetermined speed difference exists between the 'outer' and the 'inner' plates within the slip coupling. Thus, during normal travel, driving torque may be delivered to the roadwheels associated with the slip coupling even when neither wheel spinning nor wheel locking is occurring.

With a slip coupling such as described in the aforementioned Patent Specification No 1 357 106, we have found that such a device is capable of sustained delivery of relatively high values of torque simultaneously with relatively low rates of slip. Accordingly, it is further envsiaged that driving torque may be delivered to all of the roadwheels in a land vehicle solely by means of slip couplings, thus dispensing with conventional differential gears.

It is envisaged that a drive transmission in accordance with the present invention may be installed in a trailer vehicle, an associated tractor vehicle having in addition to a drive transmission for its own driven roadwheels a transmission shaft for coupling to the trailer drive transmission to carry torque to or from the trailer roadwh els when the tractor roadwheels tend to spin or lock.

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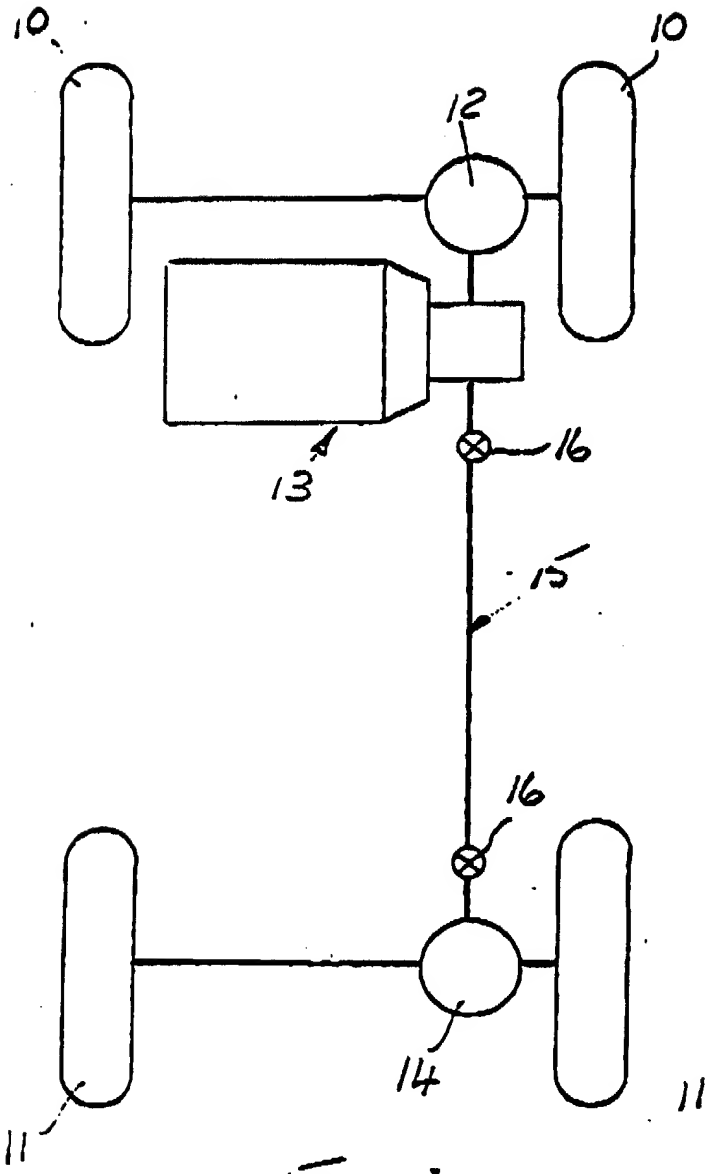

FIG. 1

EDI TO BE AMENDED

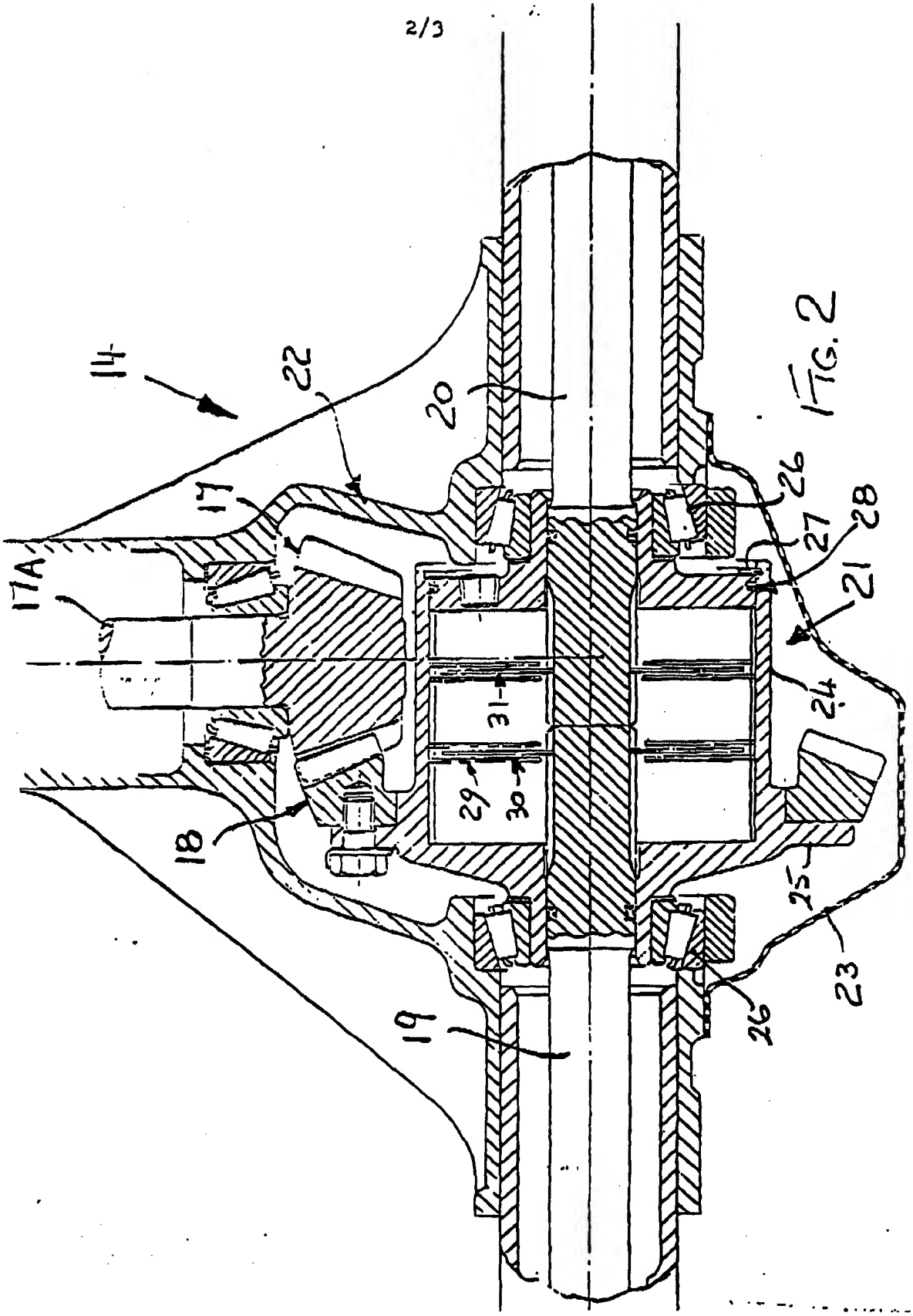

FIG. 2

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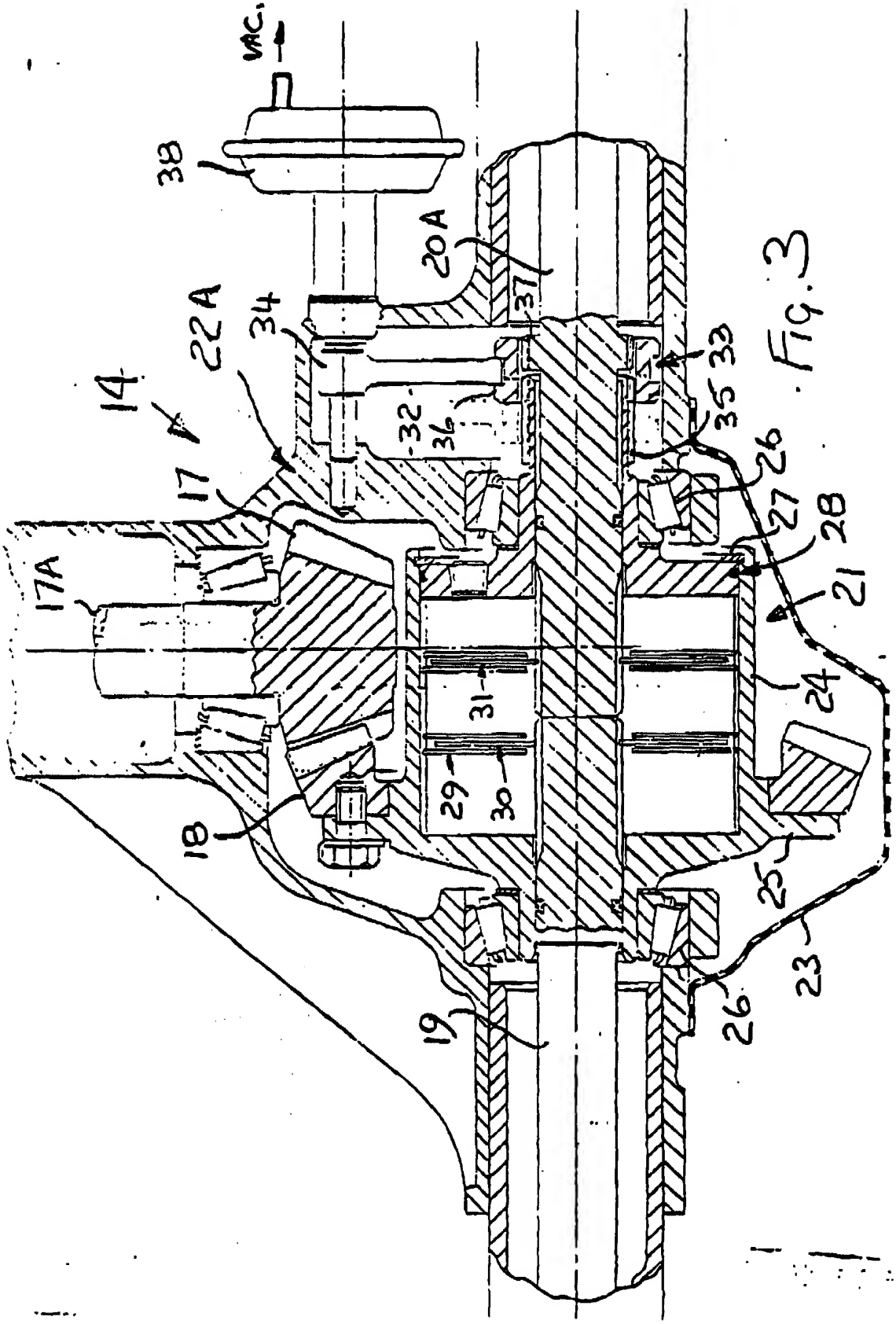

Fig. 3